JMETP

Teaching Practices Article

Activity for teaching mathematics for students with learning disabilities with analogy method : division with and without a remainder topic

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Article Info	Abstract
	One of the subjects that students with mathematics learning difficulties have difficulty with is division with and without remainders. In teaching this subject, concretization, use of analogy and gamification can be effective in understanding. Concretization, semi-concrete, abstract teaching strategy is applied. In this article, an activity for teaching division in students with mathematics learning difficulties is presented.

To cite this article

Introduction

Special Learning Disability (SLD) is an umbrella term that includes many sub-categories. One of these subcategories is learning disability in mathematics. Students who have problems in this category; It has been observed that they have difficulties in acquiring skills in calculating and counting, they have difficulties in performing arithmetic operations and they encounter problems in remembering, and because of all these issues, they are in the background compared to their peers in mathematics lessons (Olkun & Akkurt-Denizli, 2015).

These students; They also have problems in understanding basic mathematical operations such as telling time, using money, addition, subtraction, multiplication and division, and more abstract problems (for example +, -, × or ÷) (Pandey & Agarwal, 2014). Although these characteristics and inadequacies of students with mathematics learning difficulties are known, not applying any intervention program to students who have difficulties in learning mathematics may cause these students to both experience failure and feel unsuccessful in some subjects in mathematics in the following years. It is stated that the potential of mathematics to affect an individual's self-confidence, self-esteem and living standards is much more than any other discipline. When the studies are examined, it can be deduced that low performance in mathematics causes high mathematics anxiety, low self-confidence, differentiation in the choice of profession in the child, and that high mathematics performance also creates a basis for the child's self-confidence and self-esteem to lead a life in much better economic conditions in the future (Mutlu, 2020). Although estimates vary widely, it is currently thought that between 5 and 8 percent of populations worldwide have a mathematical learning disability (Butterworth, 2005; Shalev, 2007; Shalev, Manor, and Gross-Tsur, 2005).

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In order to talk about mathematics, it is necessary to talk about procedural skills. Division is a concept that students encounter at an early stage. It is possible to predict the general mathematics and algebra knowledge of these students at the high school level, with the knowledge of the division process gained by the students in the primary school period (Siegler et al., 2012; cited in Oral, 2020). Siegler et al. (2012; as cited in Oral, 2020), as a result of their research, determined that students' knowledge about division is a strong factor predicted for their competence in mathematics later in life. Students who have not learned the subject of "dividing natural numbers" have questions about what to do in their minds when they are faced with problems involving radical numbers, exponential numbers, rational numbers, integers, and division operations with fractions. The division operation is the most difficult one among the four operations, both in terms of meaning and understanding the steps of the operation (Baykul, 2002). Albayrak (2010), on the other hand, stated that the operation with the most rules among the four operations is the division operation and the division operation has a different structure from the others. Teaching the division process, which is in an important position in creating the basis for the mathematical concepts required in terms of the higher mathematical skills that students with a learning disability specific to mathematics will need in their later school life, and at the same time reducing the student's concerns about mathematics, is extremely important.

School programs, which have been under the influence of the structuralist approach since 2005 in Turkey, have made efforts to enrich the lessons with new teaching methods and techniques. One of these methods and techniques is the "analogy" method. The analogy method contributes to the systematic categorization and organization of information (Saka, Ayas, & Enginar, 2002). The development of analogies consists of 5 stages (Glynn et al. 2005);

- ➢ The target concept is specified.
- ➢ The source concept is arranged according to the target concept.
- ➢ Similar features between the source concept and the target concept are determined
- ➢ Similar features are compared.
- ➢ If there is a place or places where the analogy is broken, it is determined
- ➢ The result is drawn (as cited in Şahin, 2016).

Analogy method is mostly used in science lessons. Teaching division with the analogy method is also important in that it is prepared to be used in teaching division skills to all students, whether they need special education or not. In addition, the study includes the search for solutions to the problem rather than reflecting the existing problems in the teaching of division in mathematics learning difficulties. With this research, it is hoped that the teaching process of division in mathematics learning difficulties will become more efficient, the materials used in the research will be a resource for teachers, and the use of apology method in teaching division to students with mathematics learning difficulties will facilitate learning the division operation skill.

Implementation of Teaching Activity

According to Şahin (2000), there are four types of analogies: simple analogies, pictorial analogies, game-style analogies and story-style analogies. The purpose of this activity is to teach the skill of division using the game-style analogy method. In game-style analogies event are gamified. In this wise students will be able to learn the beginnings in division skill in a more enjoyable, meaningful and permanent way.

The materials to be used for this activity are 50 toy soldiers, 1 toy tank and 5 beads, pencils, paper. In order to arouse the interest and curiosity of the students, the activity will be started by asking some questions before the application. It was asked to make some evaluations on the students' thoughts on wars, the rules to be followed in wars, and examples of the use of analogy in lessons. The necessary materials related to this activity are prepared and the activity is started.

First Stage: Teaching Division by Analogy Method: Concretization Phase

Before starting the teaching of the concretization stage, the tools/toys representing the analogy to be used in the teaching of the basic division process were kept ready on the table.

Photo 1.

Activity of Implementation Stages

Teaching begins by saying "Welcome" to the participant. After the information about the session is presented (For example; "Today we will try to divide by playing games with you"), the session starts with the consent of the participant. Teaching begins with the practice of being a model. In the practice of being a model, the practitioner performs sample division. reads the number of divisors and divisors. The number of soldiers divided is placed on the table. It is said that as many tanks as the number of divisors can be fired in one shot. Balls are positioned where necessary. Then the basic division operation is read. It is explained that it is necessary to shoot as many guns as the number of divided enemy soldiers, and how many cannons we need to shoot to destroy all the divided soldiers. It is noted that the first shot will start from the group of soldiers farthest from the tank. Rhythmic counting begins with the number of divisors. It is continued until the appropriate number in the divided number is reached. It is said that we can throw as many balls as the number of soldiers in the divided number, and if we fire more than the number of soldiers, the balls will be wasted. However, it is reminded that it is "correct" to shoot the number closest to the divided number. In other words, it is said that the most correct shot will be to shoot the number closest to the divided number, not less than the divided number but not more than the divided number. We are asked to write the number of shots fired in the section section, and to calculate how many enemy soldiers were destroyed by subtracting the total number of balls fired from the divided number by writing under the divider. It is stated that the number written in the number of chapters is the result. It is read again with the result of the basic division operation. After the practice of being a model, the participant is given a skill instruction by saying "Now it's your turn". The participant is asked to read the basic division operation and repeat the same action that the teacher did with the toys. Correct responses are reinforced by social reinforcement, and the participant's participation in the session is reinforced by primary reinforcement after five trials. When the criteria are met in the sessions, the semi-concrete stage is started.

Second Stage: Teaching Division by Analogy Method: Semi-concretization Stage
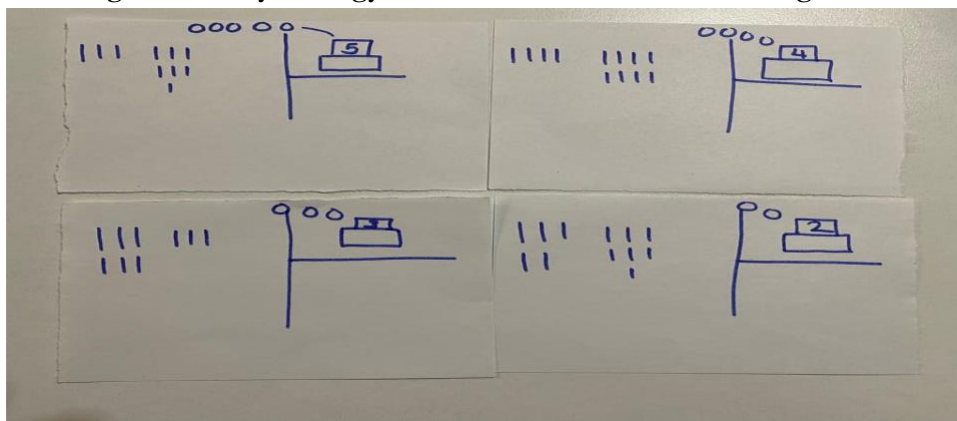

Photo 2.

Activity of Semi-concretization Stages

In the semi-concrete stage, basic division cards with pictures of soldiers, tank and gun used in analogy are used. These materials are presented to the participant one by one. Teaching begins by saying "Welcome" to the participant. Information about the session is presented. Then (For example; "Today we will work on the basic division with the cards you saw"), the session starts with the consent of the participant. Teaching begins with the practice of being a model. In the modeling application, the basic division process is first explained by the practitioner. Divider and divisor numbers are indicated. From the picture cards with the pictures of the soldiers to the divided number, the card is selected. The number of shots to be fired using the tank image is determined by rhythmic counting. When the rhythmic counting process is finished, it is checked how many times it has been counted rhythmically. and this is indicated as the result. is read again along with the result of the basic division operation. After the modeling practice, the participant is told "Now it's your turn" and the skill instruction is presented. The participant is asked to read the basic division process and choose the number of soldier picture cards as the number of divisions. and selects the tank image. Considering the number of divisors, he is asked to find how many shots he needs to make by counting rhythmically. As a result of rhythmic counting, it is said that how many times he counted rhythmically, that number is the answer of the division part of the division operation. It is expected to be read again with the result of the division operation. Correct responses are reinforced by social reinforcement, and the participant's participation in the session is reinforced by primary reinforcement after five trials. When the criteria are met in the sessions, it can be passed to the abstract stage.

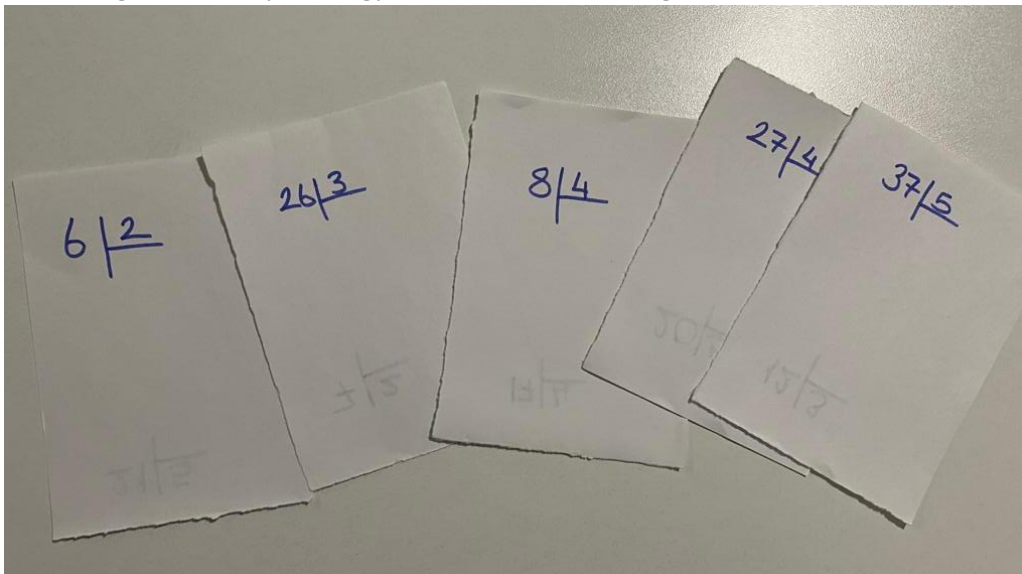**Third Stage: Teaching Division by Analogy Method: Abstract Stage**

Photo 2.
Activity of Abstract Stages

In the abstract stage, only the basic division operation cards formed from the symbolic values of the numbers are used as material. Teaching begins by saying "Welcome" to the participant. After the information about the session is presented (For example; "Today we will try to divide with you"), the session starts with the consent of the participant. Teaching begins with the practice of being a model. In the modeling application, the practitioner is reminded of the basic division process first. The number of shots fired by the tank is determined by taking into account the number of dividing and dividing. Then, the divided number is imaginatively likened to soldiers, and rhythmic counting is started by taking into account the number of divisors. When it is determined how many times it is counted rhythmically, it is said that the determined number will be written in the section part. The number of how many balls were thrown is written under the number in the dividing part. We are told that we need to perform subtraction. After the practice of being a model, the participant is given a skill instruction by saying "Now it's your turn". The participant is expected to read the basic division operation. The participant is given the opportunity to mentally tell the result after reading the basic division process. If he tells the truth, it is reinforced and a new trial is started. If he does not tell the result in his mind, the participant is asked to make an imaginary likeness to a soldier by looking at the number of divisions, and to start counting rhythmically up to the divided number by considering the number of divisors. It is said that he should determine how many times he counted rhythmically and write the determined number in the section part. It is said that he has to subtract the number of balls he has thrown by writing the number under the

number in the dividing part. The correct responses of the participant are reinforced with social reinforcement. the participant's participation in the session is reinforced with primary reinforcement at the end of five trials. When the criteria are met in the abstract stage, the teaching sessions are finished.

Chart to be Used for Measurements at the Event

Data Collection Form																
Teaching Set 1		Sessions														
Question No	Teaching Set Questions	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	6:2=															
2	8:4=															
3	12:3=															
4	20:5=															
5	7:2=															
Session Duration																
Correct Response Percentage																
Percentage of False Responses																
Percentage of No Response																

Figure 1.

Measurement Card

Conclusion

The abstract and sequential nature of mathematical skills and operations emerges as a factor that makes it difficult for students to learn mathematics (Karabulut & Yıkmış, 2010). There are many possible reasons for this situation, such as inadequate use of strategies, less motivation than expected, problems in reading and memory skills (Kumaş, Dada, & Yıkmış, 2019).

Filiz (2021) in her article titled "Examination of the Effects of Instructional Interventions on Students with Mathematics Learning Disability on the Academic Achievement of Students", it is noteworthy that students with mathematical learning disabilities encounter important problems in basic arithmetic skills and concepts, and in this activity article, most of these students are at primary school level. In addition, when the academic studies in this field are examined, it is seen that different teaching methods such as "fraction intervention program" and "schema-based teaching" have a positive effect on overcoming this difficulty (Monei & Pedro, 2017; Marita & Hord, 2016; Chodura et al. 2015; Gersten et al. 2009). The "analogy" method used in this teaching activity article is expected to have positive effects on students.

Similar instructional designs should be planned, taking into account that students with learning disabilities have strong imaginations and weak memories at the same time. Thanks to this proposed activity, the strengths of the students with learning difficulties were utilized while their weaknesses were tried to be strengthened.

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